

II. Claims

Claims 1-48 are pending in the present application. Claims 23-48 are withdrawn from consideration and have been canceled. Claims 1, 3, 7, 9, 11, 17, 19, 20 and 22 have been amended as set forth below. New Claims 49-74 have been added. This version and listing of claims replaces all prior versions and listings of claims.

1. (currently amended) A method of programming a programmable logic controller to direct a process, said programmable logic controller including a plurality of inputs and a plurality of outputs, said programmable logic controller directing said [[a]] process through output signals at said outputs in response to input signals at said inputs, comprising the steps of:

displaying to a user on a monitor a graphical data entry user interface for a plurality of sequential steps to be directed by said programmable logic controller, said graphical data entry user interface representing respective inputs to be monitored by said programmable logic controller at each of said sequential steps and respective outputs to be initiated by said programmable logic controller at respective ones of said sequential steps;

receiving for said process, via said graphical data entry user interface, an identification of at least one input selected by said user to be monitored for at least one of said sequential steps and an identification of at least one output selected by said user to be initiated for said at least one of said sequential steps;

converting said identification of said at least one input selected by said user into an input control data table, said input control data table including a plurality of input control data elements, each of said input control data elements corresponding to a respective one of said plurality of sequential steps, a respective one of said input control data elements representing said at least one input selected by said user; and

converting said identification of said at least one output selected by said user into an output data table, said output data table including a plurality of output data elements, each of said

output data elements corresponding to a respective one of said plurality of sequential steps, a respective one of said output data elements representing said at least one output selected by said user.

2. (original) The method of claim 1, wherein said graphical data entry user interface includes a timer enable command option for each of said plurality of sequential steps and a timer value option for each of said plurality of sequential steps.

3. (currently amended) The method of claim 2, further comprising the steps of:

receiving, via said graphical data entry user interface, a selection by said user of a timer enable command for at least one of said plurality of sequential steps;

receiving, via said graphical data entry user interface, a selection by said user of a timer value for said at least one of said plurality of sequential steps; and

creating a timer value data table including at least one timer value data element, said timer value data element representing said timer value,

wherein a respective one of said input control data elements represents said timer enable command for said one of said sequential steps.

4. (original) The method of claim 3, wherein said input control data element includes a plurality of bits, a subset of said plurality of bits representing individual inputs of said programmable logic controller and at least a remaining one of said plurality of bits representing said timer enable command.

5. (original) The method of claim 1, wherein said input control data element includes a plurality of bits and a subset of said plurality of bits represents individual inputs of said programmable logic controller.

6. (original) The method of claim 1, wherein said graphical data entry user interface is a check grid.

7. (original) The method of claim 1, further comprising the step of downloading said input control data table and said output data table to said programmable logic controller.

8. (original) The method of claim 1, wherein said output data element includes a plurality of bits and a subset of said plurality of bits represents individual outputs of said programmable logic controller.

9. (currently amended) An apparatus for programming a programmable logic controller to direct a process, said programmable logic controller including a plurality of inputs and a plurality of outputs, said programmable logic controller directing said [[a]] process through output signals at said outputs in response to input signals at said inputs, comprising:

means for displaying to a user on a monitor a graphical data entry user interface for a plurality of sequential steps to be directed by said programmable logic controller, said graphical data entry user interface representing respective inputs to be monitored by said programmable

logic controller at each of said sequential steps and respective outputs to be initiated by said programmable logic controller at respective ones of said sequential steps;

means for receiving for said process, via said graphical data entry user interface, an identification of at least one input selected by said user to be monitored for at least one of said sequential steps and an identification of at least one output selected by said user to be initiated for said at least one of said sequential steps;

means for converting said identification of said at least one input selected by said user into an input control data table, said input control data table including a plurality of input control data elements, each of said input control data elements corresponding to a respective one of said plurality of sequential steps, a respective one of said input control data elements representing said at least one input selected by said user; and

means for converting said identification of said at least one output selected by said user into an output data table, said output data table including a plurality of output data elements, each of said output data elements corresponding to a respective one of said plurality of sequential steps, a respective one of said output data elements representing said at least one output selected by said user.

10. (original) The apparatus of claim 9, wherein said graphical data entry user interface includes a timer enable command option for each of said plurality of sequential steps and a timer value option for each of said plurality of sequential steps.

11. (currently amended) The apparatus of claim 10, further comprising:

means for receiving, via said graphical data entry user interface, a selection by said user of a timer enable command for at least one of said plurality of sequential steps;

means for receiving, via said graphical data entry user interface, a selection by said user of a timer value for said at least one of said plurality of sequential steps; and

means for creating a timer value data table including at least one timer value data element, said timer value data element representing said timer value,

wherein a respective one of said input control data elements represents said timer enable command for said one of said sequential steps.

12. (original) The apparatus of claim 11, wherein said input control data element includes a plurality of bits, a subset of said plurality of bits representing individual inputs of said programmable logic controller and at least a remaining one of said plurality of bits representing said timer enable command.

13. (original) The apparatus of claim 9, wherein said input control data element includes a plurality of bits and a subset of said plurality of bits represents individual inputs of said programmable logic controller.

14. (original) The apparatus of claim 9, wherein said graphical data entry user interface is a check grid displayed on said monitor.

15. (original) The apparatus of claim 9, further comprising means for downloading said input control data table and said output data table to said programmable logic controller.

16. (original) The apparatus of claim 9, wherein said output data element includes a plurality of bits and a subset of said plurality of bits represents individual outputs of said programmable logic controller.

17. (currently amended) A computer-readable medium encoded with a computer program code for programming a programmable logic controller to direct a process, said programmable logic controller including a plurality of inputs and a plurality of outputs, said programmable logic controller directing said [[a]] process through output signals at said outputs in response to input signals at said inputs, the medium comprising:

a first code segment for displaying to a user on a monitor a graphical data entry user interface for a plurality of sequential steps to be directed by said programmable logic controller, said graphical data entry user interface representing respective inputs to be monitored by said programmable logic controller at each of said sequential steps and respective outputs to be initiated by said programmable logic controller at respective ones of said sequential steps;

a second code segment for receiving for said process, via said graphical data entry user interface, an identification of at least one input selected by said user to be monitored for at least one of said sequential steps and an identification of at least one output selected by said user to be initiated for said at least one of said sequential steps;

a third code segment for converting said identification of said at least one input selected by said user into an input control data table, said input control data table including a plurality of input control data elements, each of said input control data elements corresponding to a respective one of said plurality of sequential steps, a respective one of said input control data elements representing said at least one input selected by said user; and

a fourth code segment for converting said identification of said at least one output selected by said user into an output data table, said output data table including a plurality of

output data elements, each of said output data elements corresponding to a respective one of said plurality of sequential steps, a respective one of said output data elements representing said at least one output selected by said user.

18. (original) The computer-readable medium of claim 17, wherein said graphical data entry user interface includes a timer enable command option for each of said plurality of sequential steps and a timer value option for each of said plurality sequential steps.

19. (currently amended) The computer-readable medium of claim 18, further comprising:

a fifth code segment for receiving, via said graphical data entry user interface, a selection by said user of a timer enable command for at least one of said plurality of sequential steps;

a sixth code segment for receiving, via said graphical data entry user interface, a selection by said user of a timer value for said at least one of said plurality of sequential steps; and

a seventh code segment for creating a timer value data table including at least one timer value data element, said timer value data element representing said timer value,

wherein a respective one of said input control data elements represents said timer enable command for said one of said sequential steps.

20. (currently amended) A computer data signal embodied in a carrier wave encoded with computer program code for programming a programmable logic controller to direct a process, said programmable logic controller including a plurality of inputs and a plurality of

outputs, said programmable logic controller directing said [[a]] process through output signals at said outputs in response to input signals at said inputs, comprising:

a first code segment for displaying to a user on a monitor a graphical data entry user interface for a plurality of sequential steps to be directed by said programmable logic controller, said graphical data entry user interface representing respective inputs to be monitored by said programmable logic controller at each of said sequential steps and respective outputs to be initiated by said programmable logic controller at respective ones of said sequential steps;

a second code segment for receiving for said process, via said graphical data entry user interface, an identification of at least one input selected by said user to be monitored for at least one of said sequential steps and an identification of at least one output selected by said user to be initiated for said at least one of said sequential steps;

a third code segment for converting said identification of said at least one input selected by said user into an input control data table, said input control data table including a plurality of input control data elements, each of said input control data elements corresponding to a respective one of said plurality of sequential steps, a respective one of said input control data elements representing said at least one input selected by said user; and

a fourth code segment for converting said identification of said at least one output selected by said user into an output data table, said output data table including a plurality of output data elements, each of said output data elements corresponding to a respective one of said plurality of sequential steps, a respective one of said output data elements representing said at least one output selected by said user.

21. (original) The computer data signal of claim 20, wherein said graphical data entry user interface includes a timer enable command option for each of said plurality of sequential steps and a timer value option for each of said sequential steps.

22. (currently amended) The computer data signal of claim 21, further comprising:

a fifth code segment for receiving, via said graphical data entry user interface, a selection by said user of a timer enable command for at least one of said plurality of sequential steps;

a sixth code segment for receiving, via said graphical data entry user interface, a selection by said user of a timer value for said at least one of said plurality of sequential steps; and

a seventh code segment for creating a timer value data table including at least one timer value data element, said timer value data element representing said timer value,

wherein a respective one of said input control data elements represents said timer enable command for said one of said sequential steps.

23-48. (canceled)

49. (new) A method of programming a programmable logic controller to direct a process, said programmable logic controller directing said process through output signals at outputs coupled to said programmable logic controller in response to input signals at inputs coupled to said programmable logic controller, comprising the steps of:

displaying to a user on a monitor a graphical data entry user interface representing a plurality of programmable sequential steps for programming by said user to be executed by said programmable logic controller in directing a process, said graphical data entry user interface representing a plurality of inputs for selection by said user to be monitored by said programmable logic controller at each of said programmable sequential steps and a plurality of

outputs for selection by said user to be initiated by said programmable logic controller at each of said programmable sequential steps;

for each step of a control program being programmed by said user via said graphical data entry user interface requiring monitoring of inputs and/or initiation of outputs coupled to said programmable logic controller, receiving an identification of any inputs selected by said user to be monitored and an identification of any outputs selected by said user to be initiated, each step of said control program being programmed by said user corresponding to a respective step from said plurality of programmable sequential steps from said graphical data entry user interface; and

converting said identifications of said inputs and outputs selected by said user into data elements to be provided to said programmable logic controller for execution as part of said control program.

50. (new) The method of claim 49, wherein said graphical data entry user interface includes a timer enable command option for at least some of said plurality of programmable sequential steps and a timer value option for said at least some of said plurality of programmable sequential steps.

51. (new) The method of claim 50, further comprising the steps of:

receiving, via said graphical data entry user interface for said control program being programmed by said user, a selection by said user of a timer enable command for at least one of said plurality of programmable sequential steps;

receiving, via said graphical data entry user interface, a selection by said user of a timer value for said at least one of said plurality of programmable sequential steps; and

converting said timer enable command and timer value selections into data elements to be provided to said programmable logic controller for execution as part of said control program.

52. (new) The method of claim 51, wherein said identification of said inputs selected by said user are converted into an input control data table including a plurality of input control data elements, each of said input control data elements corresponding to a respective step of said control program, wherein each input control data element includes a plurality of bits, a subset of said plurality of bits representing individual inputs coupled to said programmable logic controller and at least a remaining one of said plurality of bits representing said timer enable command.

53. (new) The method of claim 49, wherein said identification of said inputs selected by said user are converted into an input control data table including a plurality of input control data elements, each of said input control data elements corresponding to a respective step of said control program, wherein each input control data element includes a plurality of bits, a subset of said plurality of bits representing individual inputs coupled to said programmable logic controller.

54. (new) The method of claim 49, wherein said graphical data entry user interface includes, for each of said programmable sequential steps, selectable graphical identifiers representing each respective one of said plurality of inputs for selection by said user and selectable graphical identifiers representing each respective one of said plurality of outputs for selection by said user.

55. (new) The method of claim 54, wherein said graphical data entry user interface comprises a check grid comprising said selectable graphical identifiers with respective grid elements associated with said plurality of inputs for selection by said user and said plurality of outputs for selection by said user.

56. (new) The method of claim 49, further comprising the step of downloading said data elements to said programmable logic controller.

57. (new) The method of claim 49, wherein said identification of said outputs selected by said user are converted into an output data table including a plurality of output data elements, each of said output data elements corresponding to a respective step of said control program, wherein each output data element includes a plurality of bits and a subset of said plurality of bits represents individual outputs coupled to said programmable logic controller.

58. (new) An apparatus for programming a programmable logic controller to direct a process, said programmable logic controller directing said process through output signals at outputs coupled to said programmable logic controller in response to input signals at inputs coupled to said programmable logic controller, comprising:

means for displaying to a user on a monitor a graphical data entry user interface representing a plurality of programmable sequential steps for programming by said user to be executed by said programmable logic controller in directing a process, said graphical data entry user interface representing a plurality of inputs for selection by said user to be monitored by said programmable logic controller at each of said programmable sequential steps and a plurality of outputs for selection by said user to be initiated by said programmable logic controller at each of said programmable sequential steps;

means for receiving, for each step of a control program being programmed by said user via said graphical data entry user interface requiring monitoring of inputs and/or initiation of outputs coupled to said programmable logic controller, an identification of any inputs selected by said user to be monitored and an identification of any outputs selected by said user to be initiated, each step of said control program being programmed by said user corresponding to a respective step from said plurality of programmable sequential steps from said graphical data entry user interface; and

means for converting said identifications of said inputs and outputs selected by said user into data elements to be provided to said programmable logic controller for execution as part of said control program.

59. (new) The apparatus of claim 58, wherein said graphical data entry user interface includes a timer enable command option for at least some of said plurality of programmable sequential steps and a timer value option for said at least some of said plurality of programmable sequential steps.

60. (new) The apparatus of claim 59, further comprising:

means for receiving, via said graphical data entry user interface for said control program being programmed by said user, a selection by said user of a timer enable command for at least one of said plurality of programmable sequential steps;

means for receiving, via said graphical data entry user interface, a selection by said user of a timer value for said at least one of said plurality of programmable sequential steps; and

means for converting said timer enable command and timer value selections into data elements to be provided to said programmable logic controller for execution as part of said control program.

61. (new) The apparatus of claim 60, wherein said identification of said inputs selected by said user are converted into an input control data table including a plurality of input control data elements, each of said input control data elements corresponding to a respective step of said control program, wherein each input control data element includes a plurality of bits, a subset of said plurality of bits representing individual inputs coupled to said programmable logic controller and at least a remaining one of said plurality of bits representing said timer enable command.

62. (new) The apparatus of claim 58, wherein said identification of said inputs selected by said user are converted into an input control data table including a plurality of input control data elements, each of said input control data elements corresponding to a respective step of said control program, wherein each input control data element includes a plurality of bits, a subset of said plurality of bits representing individual inputs coupled to said programmable logic controller.

63. (new) The apparatus of claim 58, wherein said graphical data entry user interface includes, for each of said programmable sequential steps, selectable graphical identifiers representing each respective one of said plurality of inputs for selection by said user and selectable graphical identifiers representing each respective one of said plurality of outputs for selection by said user.

64. (new) The apparatus of claim 63, wherein said graphical data entry user interface comprises a check grid comprising said selectable graphical identifiers with respective grid elements associated with said plurality of inputs for selection by said user and said plurality of outputs for selection by said user.

65. (new) The apparatus of claim 58, further comprising means for downloading said data elements to said programmable logic controller.

66. (new) The apparatus of claim 58, wherein said identification of said outputs selected by said user are converted into an output data table including a plurality of output data elements, each of said output data elements corresponding to a respective step of said control program, wherein each output data element includes a plurality of bits and a subset of said plurality of bits represents individual outputs coupled to said programmable logic controller.

67. (new) A computer-readable medium encoded with program code for causing a processor to program a programmable logic controller to direct a process, said programmable logic controller directing said process through output signals at outputs coupled to said programmable logic controller in response to input signals at inputs coupled to said programmable logic controller, comprising:

a first code segment for displaying to a user on a monitor a graphical data entry user interface representing a plurality of programmable sequential steps for programming by said user to be executed by said programmable logic controller in directing a process, said graphical data entry user interface representing a plurality of inputs for selection by said user to be monitored by said programmable logic controller at each of said programmable sequential steps and a

plurality of outputs for selection by said user to be initiated by said programmable logic controller at each of said programmable sequential steps;

a second code segment for receiving, for each step of a control program being programmed by said user via said graphical data entry user interface requiring monitoring of inputs and/or initiation of outputs coupled to said programmable logic controller, an identification of any inputs selected by said user to be monitored and an identification of any outputs selected by said user to be initiated, each step of said control program being programmed by said user corresponding to a respective step from said plurality of programmable sequential steps from said graphical data entry user interface; and

a third code segment for converting said identifications of said inputs and outputs selected by said user into data elements to be provided to said programmable logic controller for execution as part of said control program.

68. (new) The medium of claim 67, wherein said graphical data entry user interface includes a timer enable command option for at least some of said plurality of programmable sequential steps and a timer value option for said at least some of said plurality of programmable sequential steps.

69. (new) The medium of claim 68, further comprising:

a fourth code segment for receiving, via said graphical data entry user interface for said control program being programmed by said user, a selection by said user of a timer enable command for at least one of said plurality of programmable sequential steps;

a fifth code segment for receiving, via said graphical data entry user interface, a selection by said user of a timer value for said at least one of said plurality of programmable sequential steps; and

a sixth code segment for converting said timer enable command and timer value selections into data elements to be provided to said programmable logic controller for execution as part of said control program.

70. (new) The medium of claim 67, wherein said graphical data entry user interface includes, for each of said programmable sequential steps, selectable graphical identifiers representing each respective one of said plurality of inputs for selection by said user and selectable graphical identifiers representing each respective one of said plurality of outputs for selection by said user.

71. (new) The medium of claim 70, wherein graphical data entry user interface comprises a check grid comprising said selectable graphical identifiers with respective grid elements associated with said plurality of inputs for selection by said user and said plurality of outputs for selection by said user.

72. (new) The medium of claim 67, further comprising a fourth code segment for downloading said data elements to said programmable logic controller.

73. (new) A method of programming a programmable logic controller to direct a process, said programmable logic controller directing said process through output signals at

outputs coupled to said programmable logic controller in response to input signals at inputs coupled to said programmable logic controller, comprising the steps of:

displaying to a user on a monitor a graphical data entry user interface displaying a plurality of programmable sequential steps for programming by said user to be executed by said programmable logic controller in directing a process, said graphical data entry user interface including selectable identifiers for a plurality of inputs for selection by said user to be monitored by said programmable logic controller at each of said programmable sequential steps and selectable identifiers for a plurality of outputs for selection by said user to be initiated by said programmable logic controller at each of said programmable sequential steps;

for a control program being programmed by said user via said graphical data entry user interface requiring monitoring of inputs and/or initiation of outputs coupled to said programmable logic controller, receiving via said selectable identifiers an identification of any inputs selected by said user to be monitored and an identification of any outputs selected by said user to be initiated for steps in said control program, each step of said control program being programmed by said user corresponding to a respective programmable sequential step from said plurality of programmable sequential steps from said graphical data entry user interface;

wherein said graphical data entry user interface includes a timer enable command option for each of said plurality of programmable sequential steps and a timer value option for each of said plurality of programmable sequential steps, said method further comprising the steps of:

receiving, via said graphical data entry user interface, a selection by said user of a timer enable command for at least one of said plurality of programmable sequential steps;

receiving, via said graphical data entry user interface, a selection by said user of a timer value for said at least one of said plurality of programmable sequential steps; and

converting said inputs and outputs selected by said user and said timer enable command and time value selected by said user into data elements to be provided to said programmable logic controller for execution as part of said control program.

74. (new) The method of claim 73, further comprising the step of downloading said data elements to said programmable logic controller.